Dissolved Oxygen Criteria Assessment Procedure

Currently, dissolved oxygen is assessed using the monthly mean criterion for the open water designated use, the monthly mean criterion for the deep water designated use, and the instantaneous criterion for the deep channel designated use. We used the following procedure to assess the status of Chesapeake Bay waters with respect to dissolved oxygen:

1. We compiled a dataset comprising all data submitted to the Chesapeake Bay Program's water quality database (CIMS) for stations considered "tidal" for the summers (June-September) of 1991-2000.
2. We ran a program called "scenario_the_data" which uses regression equations generated from the CBP Water Quality Model to "scenario modify" the monitoring data (see the TMDL documentation for further explanation).
3. We ran a fortran computer program to reformat this flat file into a "d3d file" – a format that could be input to the Bay Program Interpolator (a Visual Basic program, version 4.61 Aug 2006, with customized data region and bathymetry files). The program, "r2d3d_ni.exe, runs on a linux platform and uses vertical profiles of temperature and salinity to calculate the upper and lower boundaries of the pycnocline for each station (in areas where deep water and deep channel designated uses occur), assigns the data to a particular cruise number by date, and splits the data into separate files for DO, salinity, and pycnocline data. The result is a set of files for each parameter, comprising files for each cruise.
4. We used the Bay Program Interpolator's vertical interpolation function (on the Data Import screen), in batch mode, to vertically interpolate each data file. We used the default settings, beginning with a 0.5 meter start depth and applying a 1.0 vertical meter step depth.
5. After vertical interpolation, we proceeded to the Interpolate screen for horizontal interpolation. We again processed the files in batch mode, with the following settings: 3D inverse-distance squared model, Min # Neighbors = 1, Max # Neighbors = 4, Horz Range (max) = 99000 (essentially only limited by each segment's data region), Vert Range (min) = 0.1 m, Vertical Range (max) = 0.1 m, vertical step size = 0.1 m, missing value = -9. The result was a file for each parameter-cruise combination, containing interpolated values for a set of cells representing the bathymetry of Chesapeake Bay (with depths in 1-meter increments).
6. Next, a fortran program (make_monthly_est_ni.exe) calculated a 30-day average for each cell, for each parameter-cell combination. The result is a set of files for each parameter which includes an individual file for each month in the three-year assessment period.
7. Next, another fortran program (vio_ni.exe), uses the interpolated pycnocline and salinity files to first divide the interpolated dissolved oxygen data into separate files for each designated use, and then to apply the appropriate criterion to calculate violation rates for each assessment segment.
8. The result is a file for each segment-designated use combination. The files contain a row for each month of the assessment period (e.g. 1993-1995), and each

row contains the following columns: "failed volume," "assessed volume,", "total volume," and "fraction failed" (calculated as failed volume/assessed volume). Special note: the deep channel designated use is assessed using the individual cruise values, *not* the monthly averages.

9. A final fortran program takes the accumulated violation rates for each segment-du and creates a cumulative frequency distribution (CFD) curve. It then compares the violation, or "assessment" CFD curve to a "reference" CFD curve, which represents an "allowable" amount of criteria violation that can still represent a healthy habitat. If the assessment CFD exceeds the reference CFD for a given designated use, then the given segment-designate use fails the criteria assessment.

Last modified by Jeni Keisman, CBPO, September 2010